SPECIAL DISTRICTS DEPARTMENT

COUNTY OF SAN BERNARDINO
CALIFORNIA

STANDARDS

FOR

DOMESTIC WATER SYSTEMS

DIVISION F
DESIGN CRITERIA AND PLAN PREPARATION

DIVISION G
TECHNICAL SPECIFICATIONS

DIVISION H
STANDARD DRAWINGS

REVISION
APRIL-14-2020

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO

TABLE OF CONTENTS
DIVISION "F"
DESIGN CRITERIA AND PLAN PREPARATION
WATER

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO

DESIGN CRITERIA AND PLAN PREPARATION
WATER

The following requirements pertain to the design and preparation of plans for construction of the various components to the water system.

1.1 General

1.1.01 Scope -- All wells, transmission and distribution mains, storage reservoirs and booster stations to be owned, maintained, and/or operated by the District shall be designed and plans prepared according to the criteria set forth in this section, and shall be so designed to conform to all applicable State and local laws, ordinances and regulations. The design shall also take into consideration any environmental restrictions applicable to a particular region.

1.1.02 Design Competence -- In general, all water facilities shall be designed by licensed Professional Engineers in the state of California according to accepted practice in the water field.

Generally, the design standards and construction standards provided herein shall be in compliance with the American Water Works Association (AWWA) and the Insurance Services Office (ISO). Other recognized standards may be accepted; however, request for use of other standards shall be offered to this agency in writing and shall include reasons for requesting a variance from the above mentioned authorities.

1.1.03 Legal Access -- Each lot to be served by water shall have frontage to a public street or recorded easement containing a water line, or be provided with permanent legal access to such a water line.

Any water facilities required for operation shall be provided within lands which have been dedicated in perpetuity and recorded, or which have been provided in fee title and recorded. Dimensions of property offered either for dedication or in fee title shall be adequate to facilitate the ultimate size of the proposed water facility and be adequate to provide space required for turning movements of heavy equipment which normally would be required to construct, maintain and replace the water facility.

1.1.04 Deviations -- Deviations from any of the criteria adopted herein may be permitted upon written request to and approval by the District.

1.2 Water Demand

1.2.01 Domestic Use -- Domestic flows shall be based on consumption records of surrounding water systems. In the absence of such records, domestic flows shall be based on the following: an average daily use of 180 gallons per capita per day; a peak daily flow of two times the average daily flow; and a peak hourly flow of four times the average annual daily flow.

1.2.02 Fire Flow -- Fire flow demand on the system shall be per the standards entitled “Guide for Determination of Required Fire Flow” published by Insurance Services Office. All fire protection water systems shall require the approval of the fire authority having jurisdiction in that given area prior to final approval of the water system design.

All fire flow requirements are over and above the average daily consumption of water, and shall be achieved at not less than twenty-(20) psi minimum residual pressure at the point of fire flow.

1.3 Design For Future Growth

Transmission and distribution mains shall be designed for ultimate demand. Storage, supply, and booster station facilities shall be reviewed by the District on a per case basis.

1.4 Supply

1.4.01 General -- The supply system shall be designed as a multi-source system capable of handling peak daily demand with the largest source of supply not in operation.

1.4.02 Wells -- Wells shall be housed in a structure compatible with the surroundings. Provisions within this structure shall be made to facilitate removing of pumps, motors and other equipment. Wells shall be located upon land to which legal access is provided and for which a permanent easement or title is recorded. Vertical turbine pumps shall meet the standards set forth in AWWA Standard E-101. All wells shall be furnished with sounding tube, air line, water meter, electric kilowatt hour meter, running time meter, air valve, gravel shoot casing vent, check valve or pump control valve, and shutoff valve on the discharge piping.

1.5 Storage

Storage capacity shall consist of operational storage plus fire flow storage as related to each pressure zone. Operational storage shall be the maximum day demand. The inclusion of emergency storage should be considered depending upon the reliability of supply.

1.6 Booster Stations

1.6.01 Pumps in Hydropneumatic Systems -- In systems where pumps shall be instantaneous peak demands, without supplementary flows from storage, the pump capacity shall be based on peak hour demand together with coincidental fire flow demand for the highest fire flow anticipated for the proposed land use with one pump out of service.

1.6.02 Pumps in Gravity Systems -- In systems with adequate available flows from storage to supplement pumping, pumping capacity should be based on peak day demand together with coincidental fire flow demand for the highest fire flow anticipated for the proposed land use with one pump out of service.

1.6.03 Structure -- Booster pumps shall be housed in a weather-tight structure compatible with the surroundings. Provisions within this structure shall be made to facilitate removing of pumps, motors and other equipment.

1.7 Transmission and Distribution Mains

1.7.01 Pipe Size -- Mains shall be sized to accommodate the greater of the following while maintaining a minimum pressure as specified in subsection 1.7.02 herein at street service connections. The minimum pipe diameter is 8".

1) peak hour demand

2) peak day demand plus fire flow

3) nighttime storage replenishment flow

The capacity of water mains shall be determined by using the Williams and Hazen Formula with an appropriate "C" value. The velocity of the water in the pipe shall be limited to 8-feet per second maximum, except in hydrant branch lines.

The maximum loss of head during either peak hour or nighttime replenishment flow conditions shall be 3-feet per 1,000 lineal feet of pipeline.

1.7.02 Operating Pressures -- Maximum pressure in mains shall not exceed 125 psi. Pressure reducers will be required on service connections where static pressure exceeds 90 psi.

Minimum pressure in mains shall be 40 psi during peak hour operation without fire flows and shall not be less than 20 psi during peak hour operation with fire flows.

1.7.03 Depth of Cover -- A minimum four – foot depth of cover from top of pipe to finish grade or top of pavement shall be maintained on all pipelines below grade. Additional cover may be required where deemed necessary by the District.

1.7.04 Location and Alignment -- Wherever possible, water mains shall be located in public streets parallel to street centerlines.

1.7.05 Clearance from Sewer Lines -- Where possible, a minimum horizontal clear distance of 10-feet shall be provided between water and sewer line laid parallel. Where such lines cross a minimum vertical clearance of 3-feet shall be provided with the sewer under the water line.

If the above conditions cannot be met, special construction will be required according to the requirements set forth on Standard Drawing No. H-1 herein.

1.7.06 Mains under Structures -- No water mains shall be located beneath a structure (including fences and block walls) except as approved in writing by the District.

1.7.07 Looped Lines and Flushouts -- Looped lines shall be provided where practical. Where dead ends are necessary, provisions for flushing shall be included. No flushing device shall be connected directly to a sewer. Flushout assembly and size shall conform to Standard Drawing No. H-8A. Blowoff assemblies shall be utilized on pipelines greater than or equal to 24 inches in diameter.

Fire hydrants may be used for flushout, where applicable, and upon approval by the District.

1.7.08 Valves -- Provide sufficient valves to permit isolation and repair of leaks and breaks, and in accordance with good water works practice. Except for transmission lines, in no case should a length of pipe greater than 1,320 feet be left without valve control. A valve box and cover shall be provided for all valves below grade and shall conform to Standard Drawing No. H-11 herein, unless part of an assembly covered by another standard drawing.

1.7.09 Fire Hydrants -- Fire hydrants shall be spaced along distribution mains as follows:

Single Family Residential (R-1)	660 feet maximum
Multiple Residential, Commercial & Industrial	330 feet maximum

Spacing of fire hydrants shall not exceed the above maximum distances but fire hydrants may be spaced at closer intervals in conformance with requirements of local fire control authorities.

Hydrants shall be located at street corners or intersection whenever practical. Hydrants shall be 5 1/4-inch Type “B” according to land use as follows:

Medium to High density residential, Commercial, and Industrial	Type “B”

Hydrant installation assembly shall conform to Standard Drawing No. H-2A and H-2B herein.

1.7.10 Service Connections -- Service connection assemblies shall conform to Standard Drawings No. H-4A and H-4B herein.

1.7.11 Air and Vacuum Valves -- Air release valves, air-vacuum valves, and air-vacuum combination valves shall be used in supply, transmission and distribution lines according to accepted practice in the water field. Air-vacuum combination valves shall be provided at high points in distribution system mains.

Valve assemblies shall conform to Standard Drawing No. H-6 herein.

1.7.12 Blowoffs -- Blowoff assemblies will be required at low points in distribution system mains 4 inches or greater in diameter.

Blowoff assemblies shall conform to Standard Drawings No. H-7A herein.

1.7.13 Thrust Blocks -- Concrete thrust blocks shall be installed as required according to Standard Drawing H-3A and H-4B herein. Where circumstances prevent the use of standard thrust blocks, special thrust restraint design shall require District approval.

1.7.14 Casing Spacers-- Installation of pipeline into a casing will require the use of restrained casing spacers, the number of spacers will vary by size, type and length of pipe. Quantities and brand to be approved by engineer/inspector.

1.8 Electrical Equipment

Electrical starters, switches, lights, motors, fixtures, controllers and instruments shall be enclosed and constructed in accordance with the National Board of Fire Underwriter’s Specifications to meet hazardous conditions anticipated. The Health and Safety Code of the State of California and National Electrical Code shall also be met.

Starters shall be of the magnetic type and shall be provided with hand-off automatic selector switches. The design of electrical equipment shall require District approval.

1.9 Automatic Controls

Wells, booster stations, and storage facilities shall be electrically inter-connected to give the system complete automatic control. Provision shall be made for manual operation of controls in the event of failure of automatic controls, and automatic controls shall be designed fail-safe, and shall meet the District's approval. Where additions to existing automatic control systems are contemplated, the design of the proposed additions and the interfacing methods shall require District approval.

1.10 Miscellaneous Requirements

1.10.01 Pump Discharge Runs -- A gate valve shall be placed on the discharge line of each pump. A pump control valve shall be placed on each discharge line between the gate valve and the pump.

Sufficient valves shall be provided to isolate each pump from the system.

An air release valve, properly vented to the outside of the pump house, shall be provided on each pump discharge line.

Pump discharge lines shall be protected from pressure surges created by starting and stopping of pumps. Pump control valves or other surge controls shall be utilized where required by the District. A pressure relief valve is required in the discharge line.

1.11 Plan Preparation

Plans prepared for additions to the District's water system and submitted to the District for approval shall be in substantial form and contain the information herein set forth. A sample plan is enclosed in the rear of Division "F."

1.11.01 -- Drawings shall be in ink on mylar. Sheet size shall be 36-inch by 24-inch with standard District title block. FINAL drawings shall be placed in AutoCAD electronic format, copied and given to the District for archiving.

1.11.02 -- The General Notes shall appear once on the first sheet of the Plans. All required certifications and approvals shall also appear on the first sheet.

1.11.03 -- Each sheet shall have a title block in the lower right hand corner.

1.11.04 -- Each sheet shall have a North arrow, where applicable.

1.11.05 -- A key (vicinity and location) map having a scale of 1 inch – 500 feet or larger shall be shown on the first sheet of each set of drawings. Said key map shall show water lines, their sizes, gate valves, fire hydrants, and appurtenances in their scaled relation to one another. All roads shall be shown.

1.11.06 -- Plan and profile are required for pipelines. Double plan and profile sheets may be used. Scales to be used are as follows:

Plan and Profile	1 inch =	40 feet horizontal
	1 inch =	4 feet vertical

If approved by the District, the following scales may be used:

	1 inch =	80 feet horizontal
	1 inch =	8 feet vertical

Profiles shall show pipe size; existing ground elevation or finish grade elevation; appurtenances; the depth, size, location, and nature of other utilities which cross over or under the water line; the location and nature of special construction such as concrete blankets or encasement; flow line elevations at grade changes; and any other information pertinent and necessary to the proper construction and recordation of the water lines.

1.11.07 -- At least one BenchMark shall be shown and/or described on each sheet. The indicated elevation shall be referenced to U.S.C. & G.S. datum.

1.11.08 -- The plans shall show the Tract and Lot numbers of property adjacent to the water line to be constructed.

1.11.09 -- The plans shall show all right of way lines, the distance from the centerline of roads, rights of way and easements to the center of the water line and other distances necessary to easements.

1.11.10 -- Show limits and type of street payment, curb, gutter, and sidewalk.

1.11.11 -- Show location of proposed service connections.

1.11.12 -- Show exact location of all structures within 20 feet of the water centerline.

1.12 Technical Specifications

The District's Technical Specifications shall be utilized in the design of water facilities. Technical Specifications are in Division "G" of the District's policies.

1.13 Standard Drawings

The District's Standard Drawings shall be utilized in the design of water facilities. Standard Drawings are in Division "H" of the District's policies.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERARDINO

TABLE OF CONTENTS
DIVISION "G"
TECHNICAL SPECIFICATIONS
WATER

Revised 4-14-2020

DIVISION "G"
TABLE OF CONTENTS (CONTINUED)

DIVISION "G"
TABLE OF CONTENTS (CONTINUED)

DIVISION "G"
TABLE OF CONTENTS (CONTINUED)

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO

PREFACE TO THE TECHNICAL SPECIFICATIONS WATER

1.0 Supplemental Definitions

Whenever in these Technical Specifications the following terms, or pronouns in place of them, are used, the intent and meaning shall be interpreted as defined in the Ordinance and Rules and Regulations of the District which regulate the use and construction of water facilities. These supplemental definitions shall apply only to the interpretation of these Technical Specifications.

Contract: The written agreement covering the performance of the work and the furnishing of labor, materials, tools and equipment in the construction of the work. The contract shall include the Proposals, Plans, Specifications, Insurance, and Contract Bonds; also, any and all written supplemental agreement amending or extending the work in a substantial and acceptable manner. Supplemental agreements are written agreements covering alterations, amendments or extensions to the contract and include contract change orders.

Plans: The official project plans, profiles, typical cross sections, general cross sections, working drawings and supplement drawings, or reproductions thereof, approved by the Engineer, which show the location, character, dimensions and details of the work to be performed, and which are to be considered a part of the Contract.

Contractor: The individual, partnership, corporation, joint venture or other legal entity entering into a contract with the District to perform the work. When the work is being done under permit issued by the District, the Permittee shall be construed to be the Contractor.

Specifications, Technical Specifications: The directions, provisions and requirements contained in the Technical Specifications for the District.

Work: All the work specified, indicated, shown or contemplated in the contract to construct the improvement, including all alterations, amendments or extensions thereto made by supplemental agreements or written orders of the Engineer. (It includes the furnishing of all labor, materials, equipment, and services.)

Engineer: the district representative that acts as the resident engineer, or engineering project manager, chief engineer of the District, or other person designated by the District, acting either directly or through authorized agents.

Design Engineer: The engineer representing the Owner that is responsible for the project engineering design.

District: The Office of Special Districts, County of San Bernardino, California

Inspector: The Individual or firm charged with the responsibility of project inspection and represents the interests of the District.

Drawings: The offered and approved project drawings.

Owner: The developer of the project.

2.0 Work Schedule

One week prior to starting construction, the Contractor shall submit to the District, Engineer and Inspector a work schedule which shall describe the sequence, time and method of operation he plans to use on the job. The Engineer reserves the right to alter this schedule where he feels the intent of the contract could not be carried out.

It shall be the Contractor's responsibility to update this schedule once a month showing work completed and work in progress. The Contractor shall provide the District, Engineer and Inspector copies of this updated schedule.

The Contractor shall notify the District, Engineer and Inspector one-week in advance of when he plans to start construction.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 1.0

EARTHWORK

1.1 General

Earthwork includes all plant labor, equipment, appliances and materials as required or necessary to clear, grub, excavate, trench, fill, backfill, and grade for the construction of all structures, pipe lines, ditches, embankments and graded areas as shown and specified.

1.2 Obstructions

All trees, shrubs, brush, including stumps and roots, fences, rocks, stones, debris and all obstructions of whatsoever kind or character. Whether natural or artificial, encountered in the construction of the work shall be removed unless otherwise specified on the construction plans or in the special conditions.

In the installation of pipelines outside of public rights of way or in easements, trees shall not be removed unless otherwise authorized in writing by the Engineer, and all fences, structures and landscaping which are removed or damaged by the Contractor shall be restored to their original condition at the Contractor's expense without any compensation therefor. Any damage done to private property by reason of work on easements shall be the responsibility of the Contractor.

Material that is removed as hereinabove specified, and is not to be incorporated in the improvement being constructed, shall be disposed of away from the construction site at Contractor's expense at an approved and lawful disposal site.

The Contractor's attention is directed to the possible existence of pipe and other underground improvements which may or may not be shown on the plans. All reasonable precautions shall be taken to preserve and protect any such improvements whether shown on the plans or not. Where it is necessary to remove and replace or to relocate such improvements in order to prosecute the work, they shall be removed, maintained and permanently replaced at no expense to the District.

1.3 Earthwork in City, County, State and Railroad Rights of Way

Earthwork within rights of way California Department of Transportation (Caltrans), the County Road Department, or any City or other governmental agency having jurisdiction, shall be done in accordance with requirements and the provisions of the permits issued by those agencies for the construction within their respective rights of way.

Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these specifications. The requirement of these Technical Specifications shall be the minimum requirement.

1.4 Safety Precautions

All excavations shall be performed, protected and supported as required for safety and in the manner set forth in the operating rules, order the regulations prescribed in the Cal/OSHA program by the Division of Occupational Safety and Health (DOSH) of the State of California. Barriers shall be placed at each end of all excavations and at places as may be necessary along excavations to prevent accidents. Lights shall also be placed along excavations from sunset each day to sunrise the next day until such excavation is entirely refilled. The Contractor shall submit to the Engineer for approval a safety barrier and traffic control plan prior to construction.

1.5 Excavated Materials

Arrangements for disposing of excess excavated material shall be made by the Contractor. Excavated material suitable for backfill shall be stored temporarily in such a manner as will facilitate work under the Contract.

1.6 Shoring, Sheeting and Bracing

Where sheet piling, shoring, sheeting, bracing, or other supports are necessary, they shall be furnished, placed, maintained and removed by the Contractor. Sheet piling and other supports shall be withdrawn in such a manner as to prevent additional backfill on the pipelines which might cause overloading. At all times the rules of Cal OSHA of the Department of Occupational Safety and Health of the State of California with respect to excavation and construction shall be strictly observed.

1.7 Clearing and Grubbing

Areas where construction is to be performed shall be cleared of all trees, shrubs, brush, rubbish, and other objectionable material of any kind which, if left in place, would interfere with the proper performance or completion of the contemplated work, would impair its subsequent use, or form obstructions therein. Trees and other natural growths outside the actual lines of construction operations shall not be destroyed and such measures as are necessary shall be taken by the Contractor for the protection thereof.

Organic material from clearing and grubbing operations will not be permitted for use as excavation backfill.

It shall be the Contractor’s responsibility to remove and dispose of all excess material resulting from clearing and grubbing operations at his/her own expense. The Contractor shall make his/her own arrangement for disposal sites at his/her own expense, at which said material may be wasted. The site shall be an approved and lawful disposal site.

1.8 Control of Water

The Contractor shall provide and maintain at all times during construction ample means and devices with which to promptly remove and dispose of all water entering the excavations or other parts of the work. No concrete footings or floors shall be placed in water nor shall water be allowed to rise over them until the concrete or mortar has set at least eight hours. Water shall not be allowed to rise unequally against walls for a period of 28 days. Ground water shall not be allowed to rise around pipe installations until jointing compound in the joints has set.

The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property and shall be in accordance with any and all permit requirements. No water shall be drained into work built or under construction. Water shall be disposed of in such a manner as not to be a menace to the public health.

Dewatering for structures and pipelines shall commence when ground water is first encountered, and shall be continuous until such times as water may be allowed to rise in accordance with the provisions of this Section.

1.9 Pipeline Excavation

1.9.01 Excavation -- Excavation for pipelines, fittings, valves, and appurtenances shall be open trench to the depth and in the direction necessary for the property installation of the same as shown on the plans or as otherwise directed by the Engineer, except where another method is specifically called for on the plans or in these specifications.

1.9.02 Limit of Excavation -- Except with specific approval of the Engineer, no more than 400 feet of open trench shall be excavated in advance of laying of pipe. All operations shall be carried out in an orderly fashion. Backfilling and clean up work shall be accomplished as sections of the pipe installation are approved. Public travel through the work shall be impeded or obstructed as little as possible. Trench plating may be allowed as long as it meets the appropriate regulations.
The remainder of the trench excavated that day shall be backfilled, compacted and the roadway opened to the public. At the end of each week, all trenches, including manhole excavations, shall be backfilled, compacted and the roadway opened to the public on Saturday, Sunday, and Holidays.

1.9.03 Tunneling -- Tunneling will be permitted only where native earth is of such firmness that it will remain in its original position, without sloughing off, throughout the work of excavation and backfilling; if sloughing occurs, the roof of the tunnel shall be broken down and the trench excavated as an open trench as herein specified.

1.9.04 Trench Width -- Banks of open cut trenches shall be kept as nearly vertical as possible. Where necessary in order to maintain the banks nearly vertical, the trench shall be properly sheeted and braced. The overall trench width shall not be more than 16 inches or less than 12 inches wider than the largest outside diameter of the pipe to be laid therein, measured at a point 12 inches above the top of the pipe exclusive of branches. Excavation and trenching shall be true to the line so that a clear space of not more than 8 inches or less than 6 inches in width is provided on each side of the largest outside diameter of the pipe in place. For the purpose of this article, the largest outside diameter shall be the outside diameter of the coupling.

1.9.05 Correction of Faulty Grades -- Should the excavation for the pipeline be carried below grade without instruction from the Engineer, it shall be refilled to proper grade with pipe zone material compacted to 90 percent relative compaction or crushed rock, at the expense of the Contractor. If compaction tests are required, they shall be at the expense of the Contractor.

1.10. Pipe Foundation and/or Subgrade

1.10.01 Foundation in Good Soil -- The trench shall have a flat or semi-circular bottom conforming to the grade to which the pipe is to be laid.

1.10.02 Foundation in Poor Soil -- All soft, spongy, or unstable material in the bottom of the trench shall be removed and replaced with approved material to a depth as determined in the field by the Engineer. The approved material shall be compacted to a minimum of 90 percent relative compaction to provide an unyielding foundation for the pipe. The removal and replacement of material from depths greater than 2 feet below the grade shown on the plans will considered as Extra Work.

1.10.03 Foundation in Rock -- Where rock is encountered, it shall be removed below grade and the trench backfilled with suitable material to provide a compacted earth cushion with a thickness under the pipe of not less than ½ inch per inch of nominal diameter of the pipe to be installed with a minimum allowable thickness of 6 inches.

1.11 Trench Backfill

1.11.01 General -- All trenches shall be backfilled after pipe, fittings, valves, and appurtenances have been installed, inspected by the inspector, and approved by the engineer.

All wood and waste material shall be removed from excavation preparatory to backfilling. Backfill material shall be approved in all cases by the Engineer and shall be free of trash, wood, large rock, or other objectionable debris. Backfilling shall include the refilling and compacting of the fill in trenches or excavations up to the subgrade of the street or to the existing ground surface.

1.11.02 Procedure in Pipe Zone -- The pipe zone shall be considered to extend the width of the trench and up to 12 inches above the top of the pipe. The backfill material in this zone shall be free of clods, clay or other deleterious materials and may contain rock which will pass a 2 ½ inch Screen in quantity not exceeding 40 percent of the volume when said coarse materials are well distributed throughout the finer materials and the specified compaction can be attained. When the excavated material is not as specified above, the Contractor shall import and place, at his/her own expense, a suitable granular backfill material. In placing the backfill in the pipe zone, particular attention is to be given to the underside of the pipe and fittings to provide a firm bedding support along the full length of the pipe. Backfill material may be densified by applying water or hand tamping. Care shall be exercised in backfilling to avoid damage to the pipe. All pipe shall be placed and backfilled in accordance with the recommendations and guidelines of the manufacturer.

1.11.03 Procedure Above Pipe Zone -- From the top of the pipe zone backfill to ground surface, the material for backfill may contain stones ranging in size up to 6 inches in diameter, in quantity not exceeding 40 percent of the volume when said coarse materials are well distributed throughout the finer materials and the specified compaction can be attained. All work necessary to conform to these requirements shall be performed at the Contractor's expense.

1.11.04 Compaction Requirements -- Whenever a relative compaction requirement value is specified, the optimum moisture content and density shall be determined in accordance with the Caltrans test method no 216 or 231 (ASTM D-1556 or D-1557). County of San Bernardino Transportation Department Road Design Standards will govern all paved road trenching, whether in County Roadways or non County roadways. A minimum of three soils compaction test per trench crossing of paved roadways shall be required at Contractors expense. The trench shall have a minimum compaction of 98% prior to asphalt repair. A 1-sack of Portland cement per cubic yard of sand slurry may be used in lieu of replacing the existing trench soil and re-compacting to a 98% soil density.

A). Compaction in roads and under structures except where governed under other jurisdiction (Caltrans, County Road Dept., City or other governmental agency having authority) will be per the governing entity. However a 95 percent minimum will be required for Class 2 aggregate base or for that portion between 0.5 foot and top subgrade.

B). Compaction in Easements -- In easements or open terrain, the backfill, if sufficiently granular (sand equivalent of 20 or greater), shall be consolidated by a method approved by the Engineer. A minimum of 90 percent relative compaction, however, will be attained.

1.11.05 Mechanically Compacted Backfill -- Mechanically compacted backfill shall be placed in horizontal layers of such depths (not exceeding those specified herein) compatible to the material being placed and the type of equipment being used. All such equipment shall be of a size and type approved by the Engineer. Each layer shall be evenly spread, moistened (or dried, if necessary), and then tamped or rolled until the specified relative compaction has been attained. Permission to use specific compaction equipment shall not be construed as guarantying or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the contract. The Contractor shall make his/her own determination in this regard. Any damage which results shall be the responsibility of the Contractor and repaired or replaced at the Contractor's expense.

Material for mechanically compacted backfill shall be placed in lifts, which, prior to compaction, shall not exceed the depths specified below for the various types of equipment.

(1) Impact, free-fall, or "stomping" equipment – maximum lift depth of 3 feet.

(2) Vibrator smooth-wheel rollers, and vibratory pneumatic-tired rollers – maximum depth of 2 feet.

(3) Rolling equipment, including sheepsfoot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels – maximum lift depth of 1 foot.

(4) Hand directed mechanical tampers -- maximum lift depth of 4 inches.

1.11.06 Water Densified Backfill -- As used in these specifications, flooding shall mean the inundation of backfill with water, puddled with poles or bars to insure saturation of the backfill material for its full depth. Jetting shall be accomplished by the use of a jet pipe to which a hose is attached carrying a continuous supply of water under pressure.

1.11.07 Requirements of Densified by Jetting -- Densified by jetting shall be subject to all of the following requirements:

(1) Application of Water

The Contractor shall apply water in a quantity and at a rate sufficient to thoroughly saturate the entire thickness of the lift being densified. Water for jetting shall be from a continuous supply of water under pressure.

(2) Use of Vibration

Where densities are required which cannot be attained by jetting alone, the Engineer may direct the Contractor to supplement the jetting process with the application of vibrating compacting equipment to the backfill.

(3) Lift Thickness

The lift of backfill shall not exceed that which can be readily densified by the jetting procedure, but in no case shall the undensified lift exceed 10 feet for jetting.

(4) Character of Material

The material being used with the water settling methods to backfill the trenches in street rights of way shall have a sand equivalent of at least 20 when tested in accordance with the Caltrans, Test Method No. “Calif. 217” and having a maximum of 10 percent passing a 200 mesh standard sieve. Where the nature of the material excavated from the trench is generally unsuitable for densification with water, the Contractor may, at no cost to the District, import suitable material for jetting, or densify the excavated material by other methods. If water densification methods are employed, the Contractor shall, at his own expense, provide a sump and pump to remove the accumulated water from the downstream end of the construction.

(5) Damage to Adjacent Improvements

The Contractor shall make his own determination that the use of flooding or jetting methods will not result in damage to existing improvements. Permission to use such methods in densifying backfill shall not be construed as guarantying or implying that adjacent ground and improvements will be unaffected.

1.11.08 Compaction Tests -- Compaction will be tested in accordance with methods specified by Highways Caltrans, test method no. 216, sandcone ASTM D-1556 or no. 231, Nuclear Gauge testing (ASTM D-2992). Sand Equivalent tests will be in accordance with Caltrans test no. 217. Compaction testing shall be the responsibility of the contractor. Final acceptance of construction will not be granted until test reports are accepted and approved by the Engineer. Frequency of tests will be as follows.

A). Longitudinal Trenches -- A complete series of compaction tests will be taken for each lift (thickness) of backfill, lifts will be determined by mechanical means of compaction (see section 1.11.05) or water densified backfill (sec. 1.11.06 & 1.11.07). Each series consists of tests taken randomly at various depths but not to exceed a maximum of 300 linear foot intervals, or as directed by the engineer.

B). Lateral Trenches -- Tests will be taken on 20 percent of all laterals constructed, one test for each 4 foot depth randomly selected.

Failing tests will be reworked and retested to the satisfaction of the Engineer by the Contractor at no cost to the District.

The Contractor, at his/her expense, shall excavate the holes for all tests, backfill the holes and compact this backfill, and repave the surface if necessary.

1.11.09 Excess Excavated Material -- The Contractor shall make the necessary arrangements for and shall remove and dispose of all excess or waste material at an approved and lawful disposal site. All costs for the disposal of excess or waste material shall be borne by the Contractor.

It is the intent of these specifications that all surplus material not required for backfill shall be disposed by the Contractor outside the limits of the public rights of way and in accordance with the requirement of the County Grading Ordinance or ordinance of any other agencies having jurisdiction at no cost to the District.

Excavated material shall not be deposited on private property unless written permission from the owner thereof is secured by the Contractor. Copies of said written permission, duly signed by the owner of the private property involved, shall be furnished to the Engineer by the Contractor before such material is placed on private property.

1.11.10 Imported Backfill Material -- Whenever the excavated material is unsuitable for backfill, the Contractor shall arrange for and furnish imported backfill material per the specifications herein at his own expense. He/she shall dispose of the excess trench excavation as specified in the preceding paragraph. The backfilling with imported material shall be done in accordance with the methods described in section 1.11.

1.12 Structural Earthwork

1.12.01 Structural Excavation -- The site shall be cleared of all natural obstructions, pavements, utilities, and other items which will interfere with construction. Any method of excavation may be employed which, in the opinion of the Contractor, is considered best. Ground shall not be dug by machinery nearer than 3 inches from any finished subgrade without the express approval of the Engineer. The last 3 inches shall be removed without disturbing the subgrade. Should the excavation be carried below the lines and grades indicated on the plans, the Contractor shall, at his own expense, refill such excavated space to the proper elevation in accordance with the procedures specified for backfill or, if under footings, the space shall be filled with concrete.

Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is authorized to be deposited directly against excavated surfaces.

1.12.02 Structural Backfilling -- After completion of foundation footings and walls, and of other construction below the elevation of the final grade, and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all debris. Unless otherwise shown, material for backfilling shall consist of excavated material, or imported sand, gravel, or other material approved by the Engineer and shall be free of trash, lumber, or other debris. Backfill shall be placed in horizontal layers not exceeding 9 inches in thickness, and shall have moisture content such that the required degree of compaction may be obtained. Each layer shall be compacted by hand or machine tampers or by other suitable equipment or means to a relative compaction of at least 90 percent. Dewatering shall be maintained during the placement of compacted clay backfill.

1.12.03 Stripping -- All vegetation, such as roots, brush, heavy sods, heavy growth of grass and all decayed vegetable matter, rubbish, and other unsuitable material within the area of the work, shall be stripped or otherwise removed before fill is started. Surfaces under paved areas, dikes, and elsewhere as directed by the Engineer, shall be wetted and compacted prior to placing fill.

1.12.04 Grading -- After stripping has been done, excavation of every description and of whatever substance encountered within the grading limits of the work shall be performed to the lines and grades indicated on the drawings. All suitable excavated material shall be transported to and placed in the fill area within the limits of the work. All excavated materials which are considered unsuitable by the Engineer, and any surplus of excavated material which is not required for fill shall be known as waste and shall be disposed of as directed in Section 1.11.09 above. During construction excavation and filling shall be performed in a manner and sequence that will provide drainage at all times.

Ditches shall be cut accurately to the cross sections and grades indicated. Any excessive ditch excavation shall be backfilled to grade either with suitable, thoroughly compacted material, or with suitable stone or cobble to form an adequate paving.

1.12.05 Fill -- Fills or embankments shall be constructed at the locations and to the lines and grades indicated on the plans. Suitable material from excavations may be used for fill. Material shall be placed in horizontal layers of from 8 to 12 inches in loose depth for the full width of the cross section and compacted as specified.

For general fill areas, the fill shall be compacted to 90 percent relative compaction.

For roadways and all areas to be paved, the fill shall be compacted, by means of tamping roller or three-wheel power roller, to at least 95 percent relative compaction.

Dikes and embankments shall be compacted by the use of compaction rollers or three-wheel power rollers to 90 percent relative compaction.

Relative compaction shall be as determined in accordance with the Caltrans Test Method No. "California 216-F," or ASTM Designations D 1557 and D1556.

1.12.06 Finish Grading -- All areas covered by the work including excavated and filled sections and transitions areas, shall be graded uniformly to the elevations shown on the plans. The finished surface shall be reasonably smooth, compacted, and free from any irregular surface changes. The degree of finish shall be that ordinarily obtainable from a blade-grader. The finished surface shall be not more than 0.1 foot above or below the established grade. Ditches shall be graded to drain readily. The surface of areas to be paved, on which a surface course is to be placed, shall not vary more than 0.05 feet from established grade and approved cross section.

1.12.07 County and City Grading Ordinances -- In addition to the requirements herein set forth for structural earthwork, all work shall be done in accordance with the requirements of the County Grading Ordinance or ordinance of any other agencies having jurisdiction.

1.13 Drilling and Blasting

1.13.01 Use of Explosives -- All operations, storage and handling of explosives shall be according to provisions of Division II, Part I, of the Health and Safety Code, State of California, and shall comply with all State, County and local laws.

1.13.02 Skilled Workmen -- Drilling and blasting are to be done only by personnel skilled in rock techniques.

1.13.03 Safety -- All necessary precautions shall be taken for protection of life and property. Warnings shall be given to nearby property owners that blasting is in progress. Safety mats shall be used to restrict flying particles. The Contractor shall size each "shot" to minimize nuisance and reduce the possibility of damage to local structures. Warning signs shall be posted along all roads, vehicle accesses and pedestrian walkway adjacent to the blasting operations. All radio transmissions within the blasting area shall be prohibited.

1.14 Final Cleanup

After all earthwork operations have been completed, the right of way and all other areas shall be dressed smooth and left in a neat presentable condition to the satisfaction of the Engineer and Owner.

1.15 Erosion Control

The contractor shall comply with all requirements for the National Pollution Discharge Elimination System (NPDES) program and obtain any and all required permits.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 2.0

CONCRETE CONSTRUCTION

2.1 General

Concrete shall be composed of Portland cement, sand, coarse aggregate, water, and admixtures as specified or approved, all well mixed and brought to the proper consistency suitable for the specific conditions of placements and in accordance with the requirements of these specifications.

2.2 Classes of Concrete

All Portland cement concrete used on the work shall be one of the classes described below. Unless otherwise stated, each class shall be used in the locations as listed:

2.2.01 Class I

Compressive Strength -3000 psi minimum.
Mix – 6-sack minimum, test required
7 sack
Use – Walls, beams, slabs, footings
Equivalent California State Highway Designation
(1984) – Class D (for 7 sack minimum)

2.2.02 Class II

Compressive Strength – 3000 psi minimum.
Mix – 6 sack (4.85 cement, 1.15 pozzolan)
Use – Walls, beams, slabs, footings (where specified on the plans).

2.2.03 Class III

Compressive Strength – 2500 psi minimum.
Mix – 6 sack
Use – Slabs, footings, walls (where specified)
Equivalent California State Highway Designation
(1984) – Class A

2.2.04 Class IV

Compressive Strength – 2500 psi minimum.
Mix - 5 sack
Use – Paving, cradles, curbs, gutters, sidewalks, thrust blocks, Manholes bases, pipe encasement, or where specified
Equivalent California State Highway Designation (1984) – Class B

2.3 Portland Cement

Unless otherwise specified, Portland cement shall be Type I or Type II complying with ASTM Designation C-595 or C-150, and shall have a total alkali content not exceeding 0.6 percent when calculated as sodium oxide as determined by methods given in ASTM Designation C-114.

2.4 Sand

Sand shall be a washed natural sand having hard, strong and durable particles and which does not contain more than 2 percent by weight of such deleterious substances as clay lumps, shale, schist, alkali, mica, coated grains, or soft and flaky particles. Sand shall be graded uniformly from fine to coarse such that the combined grading of coarse aggregate and sand set forth in Section 2.6 will be met. Not more than 3 percent shall pass the No. 200 screen as determined by ASTM Designation C-117.

2.5 Coarse Aggregate

Coarse aggregate shall be a clean, hard, fine, grained, uncoated, sound crushed rock, or washed gravel or combination of both. It shall be free from oil, organic matter or other deleterious substances and shall not contain more than 2 percent by loss of shale or cherty material; and shall show a loss of not more than 10 percent when tested for soundness in sodium sulfate solution in accordance with ASTM Designation C-88. Coarse aggregate shall be graded uniformly from one-quarter inch size to maximum.

2.6 Combined Aggregate Grading

The combined grading of coarse and fine aggregate shall fall within the following percentages by weight:

	Percentage Passing Sieves	
Sieve Size	1-1/2" Max.	1" Max.
2"	100	
1-1/2"	90-100	100
1"	50-86	90-100
¾"	45-75	55-100
3/8"	38-55	45-75
No. 4	30-45	35-60
No. 8	23-38	27-45
No. 16	17-33	20-35
No. 30	10-22	12-25
No. 50	4-10	5-15
No. 100	1-3	1-5
No. 200	0-2	0-2

2.7 Mixing Water

Mixing water shall be clean and free from deleterious amounts of acids, alkalis, salts or organic materials. Any domestic, potable water supply is acceptable. However, some waters that are not suitable for drinking (i.e. recycled and raw state project waters) may be acceptable for concrete. These waters shall meet the standards as stated in the Portland Cement Association's recommendations for the acceptance criteria for questionable water supplies. (Reference ASTM C94)

2.8 Air Entrainment

Unless otherwise specified or directed by the Engineer, water reducing and plasticizing admixtures shall be used to reduce the required mixing water, for equivalent slump in plan concrete, at least 10 percent without entraining air in excess of 2 percent by volume. If the admixture used entrains more than 2 percent air, the water reductions shall be an additional 2 percent of air entrained over 2 percent, but in no case shall air entrained exceed 5 percent. Admixtures containing Calcium Chloride are not permitted unless approved by the inspector or engineer. All admixtures shall be used in strict accordance with manufacturer's recommendations.

2.9 Pozzolan

Pozzolan shall conform to ASTM Designation C-618, except that minimum compressive strength for the lime-reactivity test shall be 1000 psi at 7 days.

2.10 Other Admixtures

No other admixtures shall be used without the Engineer's approval.

2.11 Reinforcing Steel

Reinforcing steel shall consist of deformed bars of the size called for on the plans. Reinforcing steel shall conform to ASTM A-65, and shall be Grade 60 unless specified otherwise. Mill certificates showing conformity with these requirements shall be furnished to the Engineer for each melt, if so requested. Wire reinforcement shall conform to ASTM A-82.

2.12 Tests on Concrete

From each day's placing of each class of concrete from each batching plant used, at least one set of three standard test cylinders shall be made and cured in accordance with ASTM Designation C-31. The cylinders shall be dated, numbered, and marked to indicate the location from which the sample was taken. The result of the slump test shall be noted on the cylinder. Not more than two cylinders shall be made from any one point or batch concrete. The average of three cylinders crushed at the required age shall constitute one standard test, except that occasional additional cylinders may be made for crushing at early ages to determine the approximate strength of the concrete for form stripping or other purposes.

Specimens shall be tested in accordance with ASTM Designation C-39.

The standard age of test shall be 28 days.

If more than one in ten laboratory control strength test cylinders for any structure falls below the specified compression strength, the Engineer shall have the right to order a change in proportions or the water content of any concrete for the remaining structures. If the strength of any job cured cylinders falls below the specified compressive strength, assuming they have received protection and curing equivalent to concrete in the structure, the Engineer shall have the right to require condition of temperature and moisture necessary to secure the required strength and may require tests in accordance with ASTM Designation C-42, or order load tests to be made on the structures so affected if preliminary testing with the Schmidt Impact Hammer indicates the concrete to be defective.

Any concrete found that does not meet the minimum 28 day compressive strength requirements so Specified will be removed and replaced by the Contractor at the Contractor's expense.

2.13 Mix Design

Before beginning concrete work, the proper proportions of materials for each class of concrete shall be determined by the Contractor and/or his/her supplier. The mix design shall be prepared at the Contractor's expense, by a recognized inspection and testing laboratory, approved by the Engineer, and shall show the expected strengths and corresponding slumps, and all ingredient weights and other physical properties necessary to check the design mix. A trial batch shall be made for each class of concrete to be used on the job and from each batch four standard test cylinders shall be cast, cured and tested as specified for the job concrete. Certified copies of all laboratory reports shall be sent promptly to the Engineer directly from the testing laboratory stating whether the items reported meet the Specifications. A final report shall be submitted at the completion of all concrete placement summarizing all findings concerned with concrete used in the project.

If the Contractor uses more than one supplier of concrete, each supplier shall submit their design mix as described above.

2.14 Joint Filler

Preformed fillers shall be of the type indicated on the plans and shall be installed as indicated on the plans.

2.15 Shop Drawings

Placing sheets and bending schedules shall be submitted to the Engineer for approval.

2.16 Waterstops

Waterstops shall be installed where so indicated on the plans. Waterstops shall be of polyvinyl chloride plastic and shall be lock-rib, U-centered, or flat-strip type. Proper care in placing of waterstops in forms shall be exercised so that the center bulb coincides with the construction joint. When concrete is being placed, it shall be properly vibrated to insure density at waterstop location. Waterstops shall be made continuous at splices and intersections (horizontal and/or vertical) by "welding" with a polyvinyl chloride splicing iron.

2.17 Mixing

Job mixing of structural concrete will not be permitted unless otherwise specified. When allowed, concrete shall be mixed in a batch mixer of approved type, which will insure a uniform distribution of materials throughout the mass, so that the mixture is uniform in color and homogenous. All concrete shall be placed within 90 minutes after water is first added to the batch. The mixer shall be equipped with a suitable charging hopper, a water storage tank and water measuring device controlled from a case which may be kept locked and so constructed that the water may be discharged only while the mixer is being charged. The entire contents of the mixing drum shall be discharged before recharging. The mixer shall be cleaned at frequent intervals while not in use. The volume of mixed materials per batch shall not exceed the rated capacity of the mixer.

Transit mixed concrete shall be batched, mixed and delivered in accordance with ASTM Designation C-94, except that truck agitators may not be used. All concrete shall be deposited in place not more than 45 minutes after water is added when the temperature of the concrete exceeds 85°F and not more than 1-1/2 hours after water is added when the temperature of the concrete is less than 85°. Certified public weighmaster tickets shall be delivered to the Engineer or his representative in the field prior to placing the concrete to which the ticket applies.

2.18 Consistency

The quantity of water required for the proper consistency of the concrete shall be determined by the slump test, in accordance with ASTM Designation C-143. Unless otherwise stated, slump allowances shall be as follows:

Vertical Wall Sections, Column - Maximum 4 inch plus or minus one inch.

Floor Slabs, Beams, Footings - Maximum 3 inch plus or minus ½ inch.

2.19 Retempering

Retempering of concrete that has partially hardened, that is, mixing with or without additional cement, aggregate, or water, will not be permitted.

2.20 Depositing

Concrete shall not be placed until the forms and reinforcement have been approved by the Engineer. Concrete shall be conveyed from the mixer to the place of final depositing as rapidly as possible by methods which will prevent the separation or loss of ingredients. It shall be deposited in the forms as nearly as practical in its final position with lifts not over 1-1/2 feet high, so as to maintain a plastic surface approximately horizontal. Concrete shall not be dropped more than 6 feet vertically unless a suitable chute or tube is used.

Forms for walls, or other sections of considerable height, shall be provided with openings, or other devices shall be used which will permit the concrete to be placed in a manner that will avoid accumulations of hardened concrete on the forms or metal reinforcement. Under no circumstances shall concrete that has partially hardened be deposited in the work. Temporary joints shall not remain exposed for more than 45 minutes before adjacent concrete is placed. Concrete shall be continually inspected by the inspector who shall be afforded an opportunity to check the forms for accuracy, cleanliness and position of reinforcing before the placement is started.

2.21 Subgrade Preparation

Subgrade for slabs over native earth or fill shall be finished to the exact location and section of the bottom of the slab and shall be maintained in a smooth, compacted condition, until concrete is placed. Subgrade shall be thoroughly moistened but not muddy, at the time concrete is placed. At no time shall concrete be placed in standing or running water unless approved by the Engineer.

2.22 Consolidation

Concrete during and immediately after depositing shall be thoroughly worked around the reinforcement and embedded fixtures and into corners of the forms. Internal vibrators shall be used for all walls, and self-supporting beams or slabs. Experienced workmen shall handle vibrators and care shall be taken to avoid separation of aggregate due to excessive vibration. At least one vibrator shall be used for each 15 cubic yards per hour of concrete placed. Standby vibrators shall be kept on hand.

2.23 Construction Joints

Concrete in each unit of construction shall be placed continuously, and the Contractor shall not be permitted to begin work on any part unless his facilities and forces are sufficient to complete the unit without interruption. All joints in concrete shall be located as indicated on the drawings and as approved by the Engineer. The Contractor shall submit to the Engineer for approval, drawings showing the location and sequence of pours.

All construction joints shall be made as watertight as possible. Waterstops shall be provided where called for on the plans or where deemed necessary by the Engineer. Where these methods fail, joints shall be grouted under pressure after the concrete has set and forms have been removed.

The surface of construction joints in any location shall be thoroughly cleaned and roughened by dry method sand-blasting to remove all Latinate and expose aggregate solidly embedded in the mortar matrix.

2.24 Bonding

Before new concrete is deposited on or against concrete which has set, the forms shall be re-tightened, the surface of the set concrete shall be roughened, thoroughly cleaned of foreign matter and Latinate, as specified under Section 2.23, “Construction Joints,” and sprayed with water so that the concrete is saturated but no free water is left on the surface. The new concrete placed in contact with hardened or partially hardened concrete shall contain an excess of mortar to insure bond. To insure this excess mortar at the juncture of the hardened and new deposited concrete on vertical and inclined surfaces, the cleaned and saturated surfaces of the hardened concrete shall first be thoroughly coated with a coating of neat cement grout against which the new concrete shall be placed before the grout has attained its initial set. For horizontal surfaces, a layer of at least 1-inch thick of cement mortar composed of 1 part cement and 2 parts sand shall be placed before depositing the concrete.

2.25 Curing

2.25.01 Water Curing -- Unformed concrete surfaces shall be covered with wet burlap mats as soon as the concrete has sufficiently set, and shall thereafter be kept wet under burlap until backfilled or for 14 days after the concrete is placed. Where drying conditions are severe, as determined by the Engineer, fog sprays shall be employed to prevent checking of the fresh concrete surface. Immediately following the first leveling, the fog spray shall be applied whenever the concrete surface will absorb moisture and shall be discontinued when the applied moisture is rejected. Fog spraying shall be continued as specified until the finished surface has attained sufficient strength to permit flooding or covering with burlap mats.

Formed surfaces, both interior and exterior, shall be water cured under burlap maps or by water sprays beginning as soon as the forms are stripped. Prior to stripping of forms, the concrete shall be kept moist by water sprays.

2.25.02 Curing Compounds -- With the written approval of the Engineer, concrete surfaces may be cured by curing compounds as defined below. Any concrete curing compound shall be of a nature and composition not deleterious to concrete, and thinned to a working consistency either with a volatile solvent or by emulsification with water. The curing compound shall be of a standard and uniform quality ready for use as shipped by the manufacturer.

Curing compound shall form a continuous, unbroken membrane which shall adhere to moist concrete and which will not disintegrate, check, peel from the surface, nor show signs of such deterioration within 30 days after application under actual working conditions. The compound shall be sufficiently transparent and free from color that there will be no permanent change in the color of the concrete. The compound shall contain, however, a temporary dye of sufficient color to make the membrane clearly visible for a period of at least four hours after application. If the Contractor applies a deleterious compound to paint, plaster, gunite, or other surface treatment, he shall thoroughly sandblast the surface to remove all vestiges of the compound.

2.26 Protection of Concrete Construction

All surfaces shall be protected against injury, during the first 72 hours after placing, wheeling, working, or walking on the concrete shall not be permitted. All slabs subject to wear shall be convered with a layer of sand or other suitable material as soon as the concrete has set, and either shall be cured by the use of a curing compound or shall be kept wet for not less than 14 days, or they shall be kept covered for the same period with Sisalcraft paper or other similar tough waterproof paper. All joints between adjacent strips of paper shall be sealed.

No concrete shall be placed during rain, and during such weather, all concrete placed within the preceding 12 hours shall be protected with waterproof canvas or other suitable coverings. These shall be provided and kept ready at hand.

All concrete construction shall be protected from excessive loading.

2.27 Repair and Patching

After removing forms and before the concrete is thoroughly dry, any poor joints, voids, stone pockets, or other defective areas and all tie holes shall be patched. Defective areas shall be chipped away to a depth of not less than 1 inch with the edges perpendicular to the surface. The area to be patched and a space of at least 6 inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar.

The patch shall be made of the same materials and proportions as used for the concrete, except that the coarse aggregate shall be omitted. The amount of mixing water shall be as little as consistent with the requirements of handling and placing.

The mortar shall be thoroughly compacted into place and screened, leaving the patch slightly higher than the surrounding surface. After being undisturbed for one to two hours to permit initial shrinkage, the patch shall be finished to match the adjoining surface.

Tie holes left by the withdrawal of form clamp rods or holes left by removal of snap ties shall be filled solid with mortar. For holes passing entirely through the wall, a plunger-type grease gun or other device shall be used to force mortar through the wall, starting at the back face. When the hole is completely filled, the excess mortar shall be struck off with a cloth flush with the surface. Holes not passing entirely through the wall shall be filled with a small tool that will permit packing the hole solid with mortar, any excess mortar being struck off flush with the surface.

2.28 Placing Reinforcing Steel

Reinforcing steel, before being positioned, shall be cleaned thoroughly of mill and rust scale or other coatings that will destroy or reduce the bond. Reinforcement appreciably reduced in seciton shall be rejected. Where there is delay in depositing the concrete, reinforcement shall be re-inspected and, when necessary, cleaned.

Reinforcement shall be carefully formed as indicated on the plans. Stirrups and tie bars shall be bent around a pin having a diameter of not less than three times the diameter of the bar. Except where specifically indicated otherwise on the plans, bends for other bars shall be made around a pin having a diameter of not less than six bars diameters. All bars shall be bent cold. Reinforcing steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of bars will be permitted only when the Engineer approves the entire operation. Welding on any steel reinforcing bar is not permitted.

Reinforcing steel shall be positioned accurately and secured against displacement by using annealed iron wire or suitable clips at intersections and shall be supported by concrete chairs or spacers, or metal hangers.

In slabs, beams and girders, and walls subject to lateral pressure, splices of reinforcement shall not be at points of maximum stress without the express approval of the Engineer. Splices, where permitted, shall provide sufficient lap to transfer the stress between bars (bond and shear). Adjacent bars shall not be spliced at the same point. The minimum allowable lap at points of maximum stress shall be 30 times the diameter of the larger bar of the splice, but in no case shall the lap be less than 18 inches. Minimum allowable lap distances for masonry wall reinforcement shall be 40 times the diameter of the larger bar of the splice, but in no case less than 18 inches.

2.29 Form Material

2.29.01 Class I -- For permanently exposed concrete surfaces where architectural appearance is important, Class I forms shall be constructed with particular care to assure a high type of architectural finish of uniform texture free from visible irregular ties, patch marks and discoloration. Forms shall be of synthetic resin bonded plywood especially made for concrete work or non-warping hardboard. The entire surface shall be lightly sanded, if necessary.

2.29.02 Class II -- This class shall be used for unplastered interior of all rooms and for all surfaces in contact with water such as interior walls of channels and tanks. These forms shall be of hardboard, steel or waterproof synthetic resin bonded plywood specially made for concrete work.

The Contractor shall be permitted to use the most advantageous panel sizes and panel joint location. Class II forms for painted concrete surfaces shall be free of all surface imperfections. Neat patches and minor surface imperfections will be permitted in forms for unpainted concrete provided the finished surface conforms to the requirements specified hereunder.

2.29.03 Class III -- This class shall be used for formed surfaces not exposed to view such as footings, backfilled walls, and pipe trenches. These forms shall be of metal or smooth planed boards in good condition free from large or loose knots.

2.30 Form Construction

Exposed edges of concrete on the outside and inside of structures shall be chamfered or beveled at an angle of 45°, such bevel being 1 inch on a side. If so directed by the Engineer, however, the Contractor shall provide square edges for any portion of the work.

All dirt, chips, sawdust and other foreign matter shall be removed from within the forms before any concrete is deposited therein. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being used. Before concrete is deposited within the forms, all inside surfaces of the forms shall be thoroughly coated with an approved, non-staining, form release agent which leaves no objectionable film on the surface of the forms that can be absorbed by the concrete.

Bolts, rods, or single wires shall preferably be used for internal ties and if so used shall be so arranged that when the forms are removed, no metal shall be within 1 inch of any surface. Twisted wire ties will not be permitted in the forms for any wall later to be subjected to water pressure. The Contractor shall take due precaution to prevent future leakage or seepage along ties used in all walls, which will be subjected to water pressure. Ties used in all such walls must be cut back into the face of the wall at least 1 inch and the resulting holes pointed up with 1:3 mortar.

Temporary openings shall be provided at the base of column and wall forms and at other points where necessary to facilitate cleaning and inspection immediately before depositing concrete.

Forms, bracing and shoring shall be kept in place until their removal is approved by the Engineer and in no case shall removal commence earlier than the following schedule:

Side of footings and raft ears	1 Day
Walls above ground	3 Days
Walls before ground	7 Days
Columns	10 Days
Slabs	14 Days
Beams	21 Days

Members subject to additional loads during construction shall be adequately re-shored to support both member and construction loads in a manner that will protect the member from damage or failure.

2.31 Finish of Formed Surfaces

All finished or formed surfaces shall conform accurately to the shape, alignment, grades and sections as shown on the plans or prescribed by the Engineer. Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind and shall present a finished, smooth, continuous hard surface. All sharp angles, where required, shall be rounded or beveled.

Where Class I forms are required, the surface of the concrete shall be given the following finish: After wetting the surface, a grout shall be rubbed in using a rubber float or burlap. The grout shall be made by mixing one part of cement and 1-1/2 parts of fine sand with sufficient water to give it the consistency of thick paint. After the grout hardens sufficiently, it shall be scraped from the surface with the edge of a steel trowel without disturbing the grout in the air holes. After further drying, the surface shall be rubbed with burlap to remove all surface grout. The entire surface shall be finished to secure a uniform texture.

2.32 Finish of Slabs

Where floors and flat roof surfaces are to be provided with drains, and on all exterior concrete floors, sidewalks, flat surfaces, the Contractor shall be particularly careful to provide an adequate slope to the drains or to suitable points of disposal. The direction of slope and the amount of crowning generally are shown on the plans otherwise they shall be subject to the approval of the Engineer.

2.32.01 Wood Float Finish -- The forms shall be completed with filled concrete with as little working as possible. All high or low spots exceeding ¼ inch in 10 feet shall be eliminated. The surface shall then be wood floated until it is smooth and free from blemishes.

2.32.02 Broom Finished -- Surfaces to receive a broom finish shall be wood floated as specified above, followed by steel troweling. After steel troweling and before initial set, the surface shall then be slightly roughened by means of a broom or burlap mat to produce an even textured surface finish.

2.33 Inserts

Where pipes, castings, or conduits are to pass through the walls, the Contractor shall place such pipes or castings in the forms before pouring the concrete, or in special cases, with the express consent and approval of the Engineer or as specified herein, he/she shall build approved boxes in the forms to make openings for subsequent insertion of such pipes, castings or conduits. To withstand water pressure and to insure water-tightness around the openings formed, the boxes or cores shall be provided with continuous keyways all the way around and shall have a slight flare to facilitate grouting and the escape of entrained air during grouting. The grout shall be a non-expansive Embeco grout or similar material and shall be mixed and placed in accordance with the manufacturer's instructions.

Additional reinforcement shall be provided around such openings to meet the approval of the Engineer. The space around pipes, castings, or conduits, as specified, shall be filled by pouring grout under a head of at least 4 inches. The grout shall be poured, rammed or joggled into place to fill complete space between the pipes, castings, or conduits, and the sides of the openings so as to obtain the same water-tightness as through the wall itself. The grouted castings shall then be water cured. The grouting material so placed shall be surfaced when the forms are removed to give a uniform appearance to the wall if such wall will be exposed to view.

The Contractor shall set accurately and hold in exact position in the forms until the concrete is poured and set, all gate frames, gate thimbles, special castings, channels, or other metal parts that are to be embedded in concrete, and he/she shall furnish and set accurately all inserts and anchor or other bolts necessary for the attaching of piping, valves, metal sash, and equipment. All nailing blocks, plugs, strips and the like necessary for the attachment of trim, finish and similar work and all wires suspending ceilings will be finished and placed by the Contractor.

2.34 Gunite

When the use of gunite is proposed, the Design Engineer shall submit his/her gunite design and specifications proposals to the Engineer for approval.

2.35 Pre-stressed Concrete

When the use of pre-stressed concrete is proposed, the Design Engineer shall submit his/her prestressed concrete design and specification proposal to the Engineer for approval.

2.36 Miscellaneous Concrete Mixes

Miscellaneous concrete mixes shall be used as listed below:

Use	28 Day Strength	Mix
Grout	3,000 psi min.	7 sacks with pea gravel
Mortar	1,800 psi min.	1 part cement, ¼ part lime putty, 3 parts sand
Grout for filling Masonry blocks & for bond beams	2,000 psi min.	1 part cement, 3 parts sand, 2 parts pea gravel

2.37 Cold Weather Requirements

Adequate equipment shall be provided for heating the concrete during freezing or near freezing weather. No frozen materials or materials containing ice shall be used.

All concrete materials and all reinforcement, forms, fillers and ground that the concrete is to come in contact with shall be free from ice and frost. Whenever the temperature of the surrounding air is below 40°F, all concrete placed in the forms shall have a temperature of between 70°F and 80°F and adequate means shall be provided for maintaining a temperature of between 50°F and 80°F during the curing period.

The housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heating is discontinued. The use of salt or chemicals for the prevention of freezing is prohibited.

When heating of concrete materials is required, the mixing of water and aggregate shall be heated to not more than 90°F prior to being placed in the mixer so that the temperature of the mixed concrete shall not be less than 70°F and not more than 80°F. Aggregates shall be heated either by steam or by dry heat, and the heating apparatus shall be of a type which will heat the mass uniformly and in such a manner as to preclude the possible occurrence of over-heated areas, or hot spots, which will burn the material. Flame throwers or other similar direct heating devices will not be allowed.

2.38 Hot Weather Requirements

When ambient air temperature at the job site reaches 90°F or greater, proper attention shall be given ti ingredients, production methods, placing, protection and curing to prevent excessive concrete temperatures or water evaporation that may impair required strength or service ability of the concrete. Approved methods include cooling/shading of aggregate piles and water, use of shaved ice as a partial water replacement, and shading the concrete placement area. Under no circumstances shall concrete be placed when the concrete temperature has reached or exceeded 90°F or if the concrete has reached it’s initial set. Retempering the concrete with additional water and mixing is not permitted. If shaved ice is used as a partial water replacement, it shall be fully melted at the time of mixing and the melt water shall be thoroughly mixed into the concrete mass. Pieces of unmelted ice or any frozen materials found in the concrete will be sufficient grounds for the rejection of the entire concrete batch. If the above recommended procedures are found to be insufficient in keeping the concrete temperature at or below 90°F, then the concrete placement shall be postponed until favorable weather conditions prevail.

OFFICE OF SPECIAL DISTRICTS
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 3.0

PIPELINE MATERIALS AND INSTALLATION

3.1 General

This portion of the work shall include the furnishing and installation of all materials necessary to complete the water line installation in conformance with the Plans and Specifications, true to line and grade and free from leaks, cracks, and obstructions. Where choices are allowed, the Contractor shall select such materials and construction methods as will result in a satisfactory completed project. Materials and equipment used in the work shall be new and unused unless otherwise specified. In case a reference is not clear as to which of several grades is desired, the highest quality material shall be used. Materials and strength of pipe shall be as shown on the Plans. Unless two or more materials are approved as equals, the Contractor shall not substitute another material for the one specified.

3.2 Location Tape and Wire

3.2.01 Location Tape – Locating tape will have a metallic core and shall have a minimum thickness of 0.35 mils. The tape must have imprinted continuously over its length in permanent ink "CAUTION – WATER LINE BURIED BELOW." Maximum imprint length will be 36 inches per message. Location tape shall be a minimum of 2 inches wide and be highly visible, impervious to alkalis, chemical reagents, and solvents found in the soil. The tape will be installed 18 inches below finish grade directly above the pipe. The tape will run continuously down the length of the pipe with tape running laterally on all facilities attached to the pipeline.

3.2.02 Location Wire - Location wire will be 14 Ga. Coated copper and laid continuously with the pipe. The wire will be looped and secured around each joint and the adjacent valves. The wire will be laid parallel with pipe at all connecting points a 3M connector or approved equal will be used.

3.3 Excavation and Backfill

The Contractor is referred to Section 1.0, "Earthwork," of the Technical Specifications of these specifications.

3.4 Cement Mortar Lines and Coated Welded Steel Water Pipe

3.4.01 Materials - All welded steel pipe, cement lined and reinforced mortar coated shall be the Class noted on the Plans. The materials and workmanship in the manufacture of welded steel pipe cement lined and reinforced mortar coated shall conform to the provisions of the American Water Works Association (AWWA) Standard C-200 and C-205. The thickness of the steel cylinders shall be a minimum of No. 12 gage (.1046 inch).

3.4.02 Fabrication

(1) Pipe Dimensions

The diameter of pipe shown on the Plans refers to the net actual inside diameter, after lining. The pipe shall be manufactured in sections not less than 18 feet not more than 40 feet in length and having not more than one longitudinal welded seam per section, except where shorter lengths or more than one longitudinal seam are required by special conditions.

Pipe manufactured in sections of 20 feet or less in length shall have not more than one circumferential seam. Sections more than 20 feet in length but less than 30 feet in length shall not have more than two circumferential seams. Sections 30 feet or more in length shall not have more than three circumferential seams, except where it is necessary to increase the number of seams due to special conditions.

(2) Ends of Pipe Sections

All field joints shall be 0-ring, rubber-gasketed slip joints, except where welded or flanged joints are shown on the Plans. The pipe fabricator shall furnish a written certification and guarantee stating that the 0-ring, rubber-gasketed slip joints, when properly jointed in the field, have a safe working pressure equal to the safe working pressure for steel pipe of corresponding size and gage. One end of each section shall be swaged approximately 5 inches deep with a flare lip to form the bell. The spigot end shall be formed in such a manner as to assure perfect roundness of the ends with a groove of uniform dimensions.

(3) Flanges

Flanges shall be fabricated in accordance with AWWA Standard C-207.

(4) Plain Ends for Flexible Couplings

Both ends at coupling shall be square sheared before rolling or shall be cut square after fabrication. Use of cutting torches will not be permitted.

(5) Large Radius Curves

When horizontal and vertical, large radius curves are specified, slight deflections may be made with straight pipe, provided that the deflection shall not exceed the pipe manufacturer's recommendations for maximum deflection.

(6) Fabricated Fittings

All bends, ells, tees, crosses, reducers, and other special fittings, except as specifically noted to the contrary on the Plans, shall be constructed of cement mortar lined steel pipe with a reinforced mortar coating as specified for pipe mains and shall be fabricated at the plant for delivery and installation in the work in accordance with AWWA C-208.

A modified cut and fit installation in the field will be permitted, in which case a full-engineered pipe system will not be required. The modified cut and fit installation will consist of not more than one flexible coupling per fitting.

All other connections at a fitting shall be either flanged or “O-ring” gasketed to the connecting pipe or valve. All fittings shall be shop fabricated. Fabrication drawings shall be provided for all fittings and couplings. Protection of all inside joint recesses and outside joints shall be as hereinafter specified.

Flexible joints will consist of a ball joint with a telescoping capability. This fitting may be installed in the ground, in a vault or above the surface. Installation of the fitting and the type of fitting will be approved by the Engineer.

3.4.03 Hydrostatic Test -- All pipes shall undergo hydrostatic testing in accordance with the provisions of AWWA C-2000.

3.4.04 Inspection -- The Engineer or an authorized representative shall at all times have the right to inspect the work and materials in the course of manufacture. The manufacturer shall furnish the Engineer reasonable facilities for obtaining such information as may be desired regarding the progress and manner of the work and the character and quality of materials used.

3.4.05 Loading and Transporting Pipe -- After the pipe has been properly cured, it shall be loaded on trucks or railroad cars, adequately supported and chocked with sawdust bags or by other methods approved by the Engineer. During loading and unloading operations, the pipe shall be moved with slings of sufficient width to prevent damage to the exterior coating and in such a manner as to prevent injury to the cement mortar lining.

Unloading shall be accomplish in a workmanlike manner by the Contractor who lays the pipe, and every precaution shall be taken to prevent damage to the pipe. Under no circumstances are pipe sections to be dropped or bumped in handling.

3.4.06 Installation Procedures -- All welded steel pipe shall be installed in accordance with installation instructions furnished by the pipe manufacturer, and these instructions shall be closely and carefully followed by the Contractor. The pipe shall be laid true to line and grade and at the locations as indicated on the plans, and as herein specified.

(1) Lowering

Pipe shall be carefully lowered into the trench using suitable means that will prevent disturbing the prepared foundation or getting dirt inside the pipe or couplings. All pipes ends and coupling parts shall be thoroughly cleaned before final assembly of the joint. Rubber rings and couplings sleeves shall be installed in an approved and workmanlike manner.

(2) Lubricating

A specifically prepared non-toxic and water-soluble lubricant shall be applied to machined pipe ends just prior to installation of the couplings. Proper location of all rubber rings shall be checked by use of a suitable feeler gage at all points around the circumference of coupling ends.

(3) Capping

At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trench shall be tightly closed to prevent entrance of animals and foreign materials. The Contractor shall take all necessary precautions to prevent the pipe from floating due to the water entering the trench from any source, shall assume full responsibility for any damage due to this cause, and shall, at his/her own expense, restore and replace the pipe to its specified condition and grade if it is displaced due to floating. The Contractor shall maintain the inside of the pipe free from foreign materials and in a clean and sanitary condition until its acceptance by the District.

(4) Inside Joint Recess

The inside joint recess shall be buttered with cement mortar in such a manner and in sufficient quantity to completely fill the space between the respective mortar linings. After the jointing is completed, the pipe interior shall be swabbed to remove all excess mortar by drawing an approved type swab or squeegee through the pipe. Mortar shall be as per AWWA C-602.

This procedure also applies to the inside joint recesses of all flexible couplings.

(5) Outside Joints

After the pipe has been installed, but before backfill has been completed, the exterior of the joint shall be completely mortared to a thickness at least that of the adjacent factory applied coating. Mortar shall be as per AWWA C-602.

The pipe manufacturer’s recommendations shall be followed in the fabrication of this joint.

All flexible couplings shall be coated in their entirety as outlined above.

(6) Flange Joints

Contractor shall furnish all necessary bolts and gaskets for flange joints and all other material for jointing specials, fittings and valves to pipe.

3.5 Asbestos Cement Pipe Water Lines, Couplings and Cast-Iron Fittings

3.5.01 General -- Asbestos cement pipe is not allowed for any new installations. It may be utilized for the repair of an existing asbestos cement pipe water line. The handling of asbestos cement pipe must follow the EPA/COSHA Regulations.

3.5.02 Materials -- All asbestos cement pipes shall be of the Class noted on the plans. The minimum class of asbestos cement water pipe shall be Class 150. Materials and workmanship in the manufacture of asbestos cement water pipe shall conform to the requirements of AWWA Standard C-400.

(1) Deflection

The couplings, rings, and ends of pipe sections shall be so manufactured that a deflection of five degrees (5°) may be obtained at each coupling.

(2) End Separation

Ends of pipe sections shall be so manufactured that in conjunction with couplings and rings they shall provide, when assembled, automatic separation of pipe ends.

(3) Pipe Ends

Asbestos cement pipe ends shall be of a design for which there is available, local stock, cast-iron fittings and gate valves having bells with sealing ring grooves of the same design as the ring groove of the couplings with which the pipe sections are joined.

(4) Fittings

All elbows, tees, crosses, reducers, and other special fittings in asbestos cement pipeline shall be rubber ring or bell end cast-iron fittings manufactured of tough gray cast-iron, in accordance with AWWA Standard C-110, free of all imperfections, with cement mortar lining for use with the class of pipe specified. All bolted fittings will be coated with Bitumastic or approved equal.

3.5.03 Shop Drawings -- Shop drawings of all pipe and fittings shall be submitted to the Engineer and shall be approved by him/her prior to fabrication of the pipe and fittings.

3.5.04 Installation Procedures -- All asbestos cement pipe shall be installed in accordance with installation instructions furnished by the pipe manufacturer and in accordance with AWWA standard C-603, and these instructions shall be closely and carefully followed by the Contractor.

The pipe shall be laid true to line and grade and at the location as indicated on the plans as herein specified.

3.5.05 Concrete Thrust Blocks and Pipe Encasements -- The Contractor is referred to Section 10.0, “Concrete Thrust Blocks and Blankets,” of the Technical Specifications of these specifications.

3.5.06 Testing and Disinfection of Water Lines -- The Contractor is referred to Section 9.0, “Testing and Disinfection of Water Lines,” of the Technical Specifications of these specifications.

3.6 Polyvinyl Chloride (PVC) Pipe Water Lines, Couplings and Cast-Iron Fittings

3.6.01 Materials -- All PVC pipe shall be of the Class shown on the Plans. The minimum class of PVC pipe shall be Class 150. Materials and workmanship in the manufacture of PVC pipe shall conform to the requirements of AWWA Standard C-900 and C-905. Standard lengths of PVC pipe shall be 20 feet.

(1) Deflection at Joints

Deflection couplings of the same class as the adjacent pipe shall be used on curvilinear alignments or where otherwise required.

(2) Large Radius Curves C-900

When Horizontal and Vertical Large Radius Curves are specified, slight deflections of (2.5°) up to 8” and (1°) 10” and up may be made with straight pipe.

(3) Ends of Pipe Sections

Joints shall be rubber-gasketed slip joints, unless otherwise shown on the Plans or where deflection joints are necessary.

(4) Fittings

All elbows, tees, crosses, reducers, and other special fittings in asbestos cement pipeline shall be rubber ring or bell end cast-iron fittings manufactured of tough gray cast-iron, in accordance with AWW Standard C-110, free of all imperfections, with cement mortar lining for use with the class of pipe specified. All bolted fittings will be coated with Bitumastic or approved equal.

3.6.02 Installation Procedures -- All PVC shall be installed in accordance with installation instructions furnished by the pipe manufacturer and according to AWWA Manual M23, PVC Pipe-Design and Installation.

3.6.03 Concrete Thrust Blocks and Pipe Encasements -- The Contractor is referred to Section 10.0, “Concrete Thrust Blocks and Blankets,” of the Technical Specifications of these specifications.

3.6.04 Testing and Disinfection of Water Lines -- The Contractor is referred to Section 9.0, “Testing and Disinfection of Water Lines,” of the Technical Specifications of these specifications.

3.6.05 End of the Line, Cross and Tee -- All pipeline installations that have an ending point with out connecting to an existing pipeline will have a fitting (tee or cross), isolation valve, a 5' long length of pipe stubbed out, end cap and a thrust block installed. The 5' section of pipe will allow for future tie-ins to the system. All pipelines with the possibility for future connections will require installation of pipe and fitting restraints 100' before the end of the line including the tee or cross and isolation valve.

3.6.06 Tie-In's -- All tie-in's will be scheduled with the inspector or with an authorized District Employee. If the tie-in requires the existing water system to be shut-down the contractor will be required to complete the tie-in to the water system in a timely manner, not to exceed 8 hours. If more time is needed, special arrangements must be made with the system supervisor. If there are fittings that require thrust blocks to harden before the system can be brought back on line the contractor must make arrangements to install a temporary thrust system to prevent fitting from moving until the concrete hardens. All temporary mechanical type restraints will require approval by the district engineer or his representative before tie-in can be scheduled.

3.6.07 Tie-In Fittings -- If the tie-in point is at an AC type fitting the contractor will install a Newby transition rubber or approved equal to transition from C900 or Ductile iron pipe to the AC fitting. If the tie-in point is at a section of AC pipe the contractor will use a 10" long JCM "Optimum Range Coupling" or an approved equal. If the tie-in point is at a section of C900 to C900 the contractor will use a 12" long Tyler/Union coupling or a C900 repair coupling or an approved equal.

All in line push on type Bell reducers will be restrained on both sides of the fitting with pipe restraints.

3.6.08 Backfill Stabilizer -- Backfill stabilizers will be installed for all slopes with 16 degree fall or greater. The number of stabilizers require for a project will be determined by the engineer and will take into consideration the length and degree fall on a particular slope. The stabilizer will be installed in undisturbed soil with #4 re-bar framework as shown on drawing H-18.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 4.0

FIRE HYDRANT ASSEMBLIES

4.1 General

Fire hydrant assemblies shall be as called for on Standard Drawings No. H-2A and H-2B and as specified in the other applicable sections of these specifications.

Fire hydrants shall be Mueller or approved equal only and shall be the post-type dry-barrel type conforming to the Standard for Dry-Barrel Fire Hydrants (AWWA C502). An Affidavit of Compliance may be required from the manufacturer to the effect that the materials furnished under the purchaser's order comply with all applicable requirements of this standard.

Fire hydrants shall have a 6-inch inlet connection with a minimum 5-1/2 inch I.D. compression type main valve, 1-1/2 inch pentagon nut that turns to the left (counter clockwise) to open, and 0-ring stem seals. Type "B" fire hydrants shall be equipped with one 4-inch California Standard thread pumper outlet and two 2-1/2 inch National Standard hose thread outlets. Hose nozzles shall be threaded in type and retained with a setscrew. Caulked or leaded nozzles are not acceptable. Outlet nozzles shall be provided with outlet caps and caps shall be securely chained to the hydrant barrel with a metal chain as specified in AWWA C502. Hydrants shall be traffic models with suitable bolted or 3'x3'x6" nonslip concrete pad installed around the base of the break away to insure that no lateral movement occurs when hit, that causes fractures on impact without flooding, provided near the ground level. The bonnet shall be dry top and factory packed with grease, oil reservoir or equal. Hydrants shall have a bronze drain way with two drain holes to adequately drain the barrel when the hydrant is closed, and said drain opening shall be capable of accepting a tapered, self-tapping screwed plug for the purpose of either slowing or stopping the drain stream flow when the hydrant is in a partially opened position 1 cubic foot of gravel shall be placed around each drain hole to facilitate drainage. All working parts including the main valve and seat ring shall be removable through the tope of the hydrant without necessity of excavation.

The manufacturer's warranty for the hydrants shall be required prior to approval of their use.

4.2 Excavation and Backfill

The Contractor is referred to Section 1.0, "Earthwork," of the Technical Specifications of these specifications.

4.3 Painting

All fire hydrants shall be surface prepared to receive paint by scraping and wire brushing, and shall be painted with one (1) coat of surface primer and two (2) coats of finish paint. The paint shall be 215958 single application Heavy Duty Rust Inhibitive Red Primer and 215950 single application Safety Yellow Finish coat, as manufactured by Rust-Oleum, or approved equal paint system using compatible primer and finish supplied by one manufacturer.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 5.0

FLUSH-OUT AND BLOWOFF ASSEMBLIES

5.1 Flush-Outs

Flush-out assemblies shall be as called for on the Special District's Standard Drawing No. H-7A, and H-7B and as specified in other applicable sections of these specifications.

Flush-outs shall be constructed in the size and at the locations shown on the plans.

5.2 Excavation and Backfill

The Contractor is referred to Section 1.0, "Earthwork," of the Technical Specifications of these specifications.

5.3 Blowoffs

Blowoff assemblies shall be as called for on Standard Drawing No. H-7A and H-7B and as specified in the other applicable sections of these specifications.

Blowoffs shall be constructed in the size and at the locations shown on the plans.

5.4 Protective Coatings

All portions of flush-out and blowoff pipe and appurtenances extending above finished grade shall be surface prepared to receive paint by scraping and wire brushing, and shall be painted with one (1) coat of surface primer and two (2) coats of finish paint. The paint shall be 215958 single application Heavy Duty Rust Inhibitive Red Primer and 215950 single application Safety Yellow finish coat as manufactured by Rust-Oleum, or approved equal paint system using compatible primer and finish supplied by one manufacturer. All flush out and blowoff pipe below grade shall be standard steel or galvanized pipe (Schedule 40), asphalt coated.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 6.0

VALVES, VALVE BOXES AND COVERS

6.1 Gate Valves

Gate valves shall be iron-body Mueller valves or approved equal only, resilient-seated gate valves with non-rising stem and 0-ring seals. Gate valves shall conform to the Standard Specifications for gate valves, 3 inches through 12 inches, for water and other liquids (AWWA C-509) of the American Water Works Associations.

An Affidavit of compliance may be required from the manufacturer to the effect that the materials furnished under the purchaser's order comply with all applicable requirements of this standard.

Valves shall be designed to operate for cold water service with up to 200 psi working pressure on either side of the valve.

Underground valves shall be fitted with 2 inch operating bolts and exposed valves shall be furnished with handwheels. All valves shall turn to the left (counter clockwise) to open the valve.

All internal parts shall be accessible without removing the main body from the pressure line. All ferrous metal internal parts shall be epoxy coated with a factory applied corrosion resistant coating of at least 4-mil thickness conforming to AWWA Standard C-550.

6.2 Butterfly Valves

Butterfly valves for use on larger diameter mains shall be of the Class 150B rubber-seated tight closing type. They shall meet or exceed the requirements of AWWA Standard C-504. Valve body shall be high strength cast-iron ASTM A126 Class B. Shaft seals shall be 0-ring type.

An Affidavit of Compliance may be required from the manufacturer to the effect that the materials furnished under the purchaser's order comply with all applicable requirements of this standard.

Underground valves shall be fitting with 2 inch operating nuts and exposed valves shall be furnished with handwheels. All valves shall turn to the left (counter clockwise) to open the valve.

6.3 Excavation and Backfill

The Contractor is referred to Section 1.0, "Earthwork," of the Technical Specifications of these specifications.

6.4 Valve Ends

The valve ends shall be of the type shown on the plans. Valves with welding ends will not be permitted for use in welded steel lines.

6.5 Valve Boxes and Covers

Valve boxes shall be provided for all valves which are set in the ground and shall extend to a point flush with the finished or established ground or paved surface. Valve boxes covers shall be as manufactured by Alhambra Foundry, No. A-29606, or approved equal.

The valve box shall be adjustable and shall consist of a 6-5/8 inch by 18 inch steel (10 gage) valve box top with a cast-iron cover that extends into the valve box top. The bottom sections shall be 6-inch SDR35 pipe and be of varying length to meet field conditions.

Where valve operating nuts are more than 60 inches below finish surface, the Contractor shall install a valve extension stem either of standard manufacture or shop fabricated, which shall bring the operating nut to within 12 inches of the surface. The extension stem shall be made of solid round steel bar of diameter equal to the valve stem diameter with a minimum of 1-inch diameter or extra heavy steel pipe of a minimum of 1-1/4 each inside diameter. The stem extension shall have a round disc dirt shield guide made of ¼ inch minimum thickness solid steel plate having a diameter approximately ½ inch less than the valve cover inside diameter which will allow smooth stem operation.

Installation of the valve box and cover shall conform to Standard Drawing No. H-11 and to other applicable drawings.

(1) Nameplate

The nameplate on each and every valve box cover shall read as follows: “WATER”

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 7.0

WATER SERVICES

7.1 General

Where the District requires the Contractor to install water services, the Contractor shall furnish and install the materials in accordance with the standards herein. Services shall be installed at the locations shown on the plans, at right angles to the centerline of the main, and shall be spaced a minimum of 10 feet from any sewer lateral. No services will be permitted in driveway areas.

All pipes, valves and fittings shall have a minimum working pressure rating of 200 pounds per square inch. Pipe ends, where joining special fittings, compression for adaptation to copper tube couplings.

Water service connections shall be installed in conformance with Standard Drawings No. H-4A, H-4B, H-5, H-10, H-13 and H-14 and other applicable Standard Drawings.

Fire detector check valve assemblies (Std. Dwg. No. H-5) shall be used for services requiring sprinkler systems or other privately owned fire protection systems.

A backflow prevention device (Std. Dwg No. H-13 or H-14) shall be required if it is determined by the District that the type of occupancy could impose a health hazard.

7.2 Earthwork

The Contractor is referred to Section 1.0, “Earthwork,” of the Technical Specifications of these specifications.

7.3 Plastic Water Service Tubing

All plastic water service tubing shall be manufactured by extrusion from virgin plastic compound, Type III, Grade P34, Class C Polyethylene Resin (PE3408) as defined by ASTM D 2737.

Extruded tubing shall have a Standard Dimension Ratio (SDR) of 9. All service tubing shall be rated for use with water at 73.4°F at a minimum hydrostatic design stress of 1,250 psi.

All service tubing delivered to the job site shall be clearly marked at intervals of not more than 2 feet with the following information: nominal size tubing, type of material, SDR, pressure rating, ASTM designation, manufacturer’s trade name and production code and seal of approval of an accredited testing laboratory.

All plastic tubing shall be Driscoplex 5100 Ultra-Line “CTS” Poly Tube (200 PSI working pressure)

7.4 Angle Meter Stops

All 1-inch angle meter stops shall be Mueller only, H-14250 or approved equal.

All 1-1/2 inch and 2 inch angle meter stops shall be flanged Mueller H-14276 or approved equal.

7.5 Corporation Stops

All corporation stops shall be Mueller H-15000 or H-15025 or approved equal.

7.6 Service Saddles

All service saddles for asbestos cement pipe shall be Mueller A-16100 BR1B and solid bronze or approved equal.

All service saddles for AWWA C900 PVC pipe shall be BR1B Mueller only and solid bronze or approved equal.

Service saddles used on cement mortar lined and coated steel pipe shall be Rockwell 362 or approved equal.

7.7 Meter Box

Meter boxes shall be Brooks Products Poly Plastics No. 1419 with snap-lid or No. 3 concrete box used only in concrete and asphalt applications and lid for ¾ inch services; No. 1320 or No. 37 for 1 inch services; and No. 1730 or No. 66 for 1-1/2 inch to 2 inch services; or approved equal.

7.8 Main Pipeline Hot Tap

Size on taps require a 5-piece, cast iron sleeve with mechanical joint ends per Mueller H-615 and H-616. All other will use 622 smith & Blair apoxy coated or approved equal.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 8.0

AIR AND VACUUM AND AIR RELEASE ASSEMBLIES

8.1 General

The air and vacuum valve, air release valve, valves, unions, piping, vault, vault lid, and other appurtenances shall be as called for on Standard Drawing No. H-6 "Air and Vacuum Valve Assembly", and other applicable Standard Drawings. Installations shall be made at the locations shown on the plans.

8.2 Earthwork

The Contractor is referred to Section 1.0, "Earthwork," of the Technical Specifications of these specifications.

8.3 Plastic Water Service Tubing

All plastic water service tubing shall be manufactured by extrusion from virgin plastic compound, Type III, Grade P34, Class C, Polyethylene Resin (PE3408) as defined by ASTM D 2737.

Extruded tubing shall have a Standard Dimension Ratio (SDR) of 9. All service tubing shall be rated for use with water at 73.4°F at a minimum hydrostatic design stress of 1,250 psi.

All service tubing delivered to the job site shall be clearly marked at intervals of not more than 2 feet with the following information: nominal size tubing, type of material, SDR, pressure rating, ASTM designation, manufacturer's trade name and production code and seal of approval of an accredited testing laboratory.

All plastic tubing shall be Drisco CTS Poly or approved equal.

8.4 Corporation Stops

All corporation stops shall be Mueller H-15020 or H-15045 or approved equal.

8.5 Curb Valves

All curb valves shall be Mueller H-15175 or approved equal.

8.6 Air and Vacuum Valves

All air and vacuum valves shall be Apco Series 140, 1 inch 140, 2 inch 142, Crispin Type AL, or approved equal.

8.7 Air Release Valves

All air release valves (compound level) shall be Crispin Type PL, Apco Series 200, 1 inch 200A, 2 inch 200, or approved equal.

8.8 Air and Vacuum Combination Valves

All air and vacuum combination valves shall be Crispin UL Apco Heavy duty Combination Air Release Valve, 1 inch 143C, 2 inch 145C, or approved equal.

8.9 Meter Box and Lid

All meter boxes and lids shall be AEP 1015/T-26 lid or approved equal. The meter box size shall be adequate to contain and allow room to service all valves and appurtenances contained herein.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BENARDINO
TECHNICAL SPECIFICATIONS

SECTION 9.0

TESTING AND DISINFECTION OF WATER LINES

9.1 General

It is the intent of the Plans and Specifications that the completed water pipes, blowoffs, flush-outs, hydrants and other appurtenances shall be water tight and clean.

9.2 Testing

Pressure and leakage tests shall be performed in accordance with AWWA C603 except as herein modified.

Separate tests shall be performed for structural and leakage. After trenches are backfilled and compacted, the pipelines shall be subjected to a structural hydrostatic pressure test of 50 pounds per square inch in excess of the allowable working pressure for the class of pipe to be tested for a period of two hours. Any noticeable leaks shall be stopped on any defective pipe shall be repaired and replaced with new sections and re-tested as specified above.

All labor, material and equipment for test shall be furnished by the Contractor. Water for the test shall be furnished by the Contractor.

9.3 Disinfection of water Mains

Before being placed in service, each portion of the line shall be disinfected in accordance with the American Water Works Association Standard for Disinfecting Water Mains, AWWA C651.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 10.0

CONCRETE THRUST BLOCKS, RESTRAINTS AND BLANKETS

10.1 General

Concrete thrust blocks shall be installed in accordance with Standard Drawings No. H-3A and H3-B. Restraints shall be installed as required by District per Standard Drawings No. H-3C and H3-D. Blankets shall be installed per standard H-12 at the locations on the plans and in conformance with these specifications.

10.1.01 Plastic Wrap -- All fittings to be wrapped in 10 mil plastic or approved equal when in contact with concrete thrust block.

10.1.02 Bearing Area -- Bearing area may vary with soil type, sandy/loss soil will require larger bearing area.

10.2 Concrete Blanket

10.2.01 General -- Concrete blanket shall be constructed at the locations shown on the plans and in accordance with Standard Drawing No. H-12. Concrete shall be of Class IV Portland Cement concrete, containing not less than five sacks of Portland cement per cubic yard.

10.2.02 Blanket Type -- A Type I blanket is to be used in a location where the pipe is to be protected from surcharge and wheel loadings.

A Type II blanket is to be used at locations where the pipe installation is to be protected from erosion due to the flow of water over the pipe.

SPECIAL DISTRICTS DEPARTMENT
COUNTY OF SAN BERNARDINO
TECHNICAL SPECIFICATIONS

SECTION 11.0

CHAIN LINK FENCE AND GATE

11.01 General

The Contractor shall furnish and install the chain link fencing as shown and specified; replace chain link or barbed wire fencing damaged by his operations. All fencing materials shall be hot-dip galvanized. Fencing shall be topped with 3 lines of barbed wire unless otherwise shown. Fencing shall be 7 feet high unless otherwise shown.

11.02 Materials

(a) Fabric shall be No. 9 gage galvanized steel wire, 2-inch mesh.

(b) Fabric ties shall be No. 9 gage galvanized steel wire, spaced 14 inches apart on posts and 24 inches apart on rails. Aluminum ties will not be permitted. A continuous No. 7 gage galvanized steel wire shall be interlaced with the fabric or attached to the fabric with clips along the extreme bottom of the fence, and shall be pulled taut.

(c) Line post shall be standard weight 2-1/2-inch OD pipe, 3.65 lbs. per foot.

(d) End and corner post shall be 3-inch OD pipe, 5.79 lbs. per foot.

(e) Gate posts shall be made from 4-inch OD pipe, 9.1 lbs. per foot.

(f) Top rail braces shall be made from 1-5/8 inch OD pipe, 2.27 lbs. per foot.

(g) Barbed wire shall be 2-stnd, 4-point pattern, 12-1/2 gage galvanized steel or iron wire with barbs spaced 5-inches apart, conforming to ASTM A-121.

(h) Nuts, bolts, and screws shall be galvanized steel, minimum size 3/8-inch diameter.

(i) Swing gate frames, if any, shall be constructed of pipe at least as heavy as the top rails for the fence and shall be fabricated by welding. Each gate leaf shall be provided with at least one diagonal brace. Frames shall be galvanized after fabrication. Galvanized malleable iron fittings for latching the gate shall be provided. Fabric shall match the fabric used in the fence. Each pair of gates shall be provided with a heavy drop rod latch assembly with a locking device for a padlock (see the detailed drawings for both the fence and gate).

(j) Concrete shall have a minimum compressive strength of 2,000 psi at the age of 28 days.

11.03 Installation

(a) Post shall be set plumb and shall be centered in concrete encasement. The top surfaces of the concrete encasement shall be sloped outward to shed water and shall have a neat appearance.
Line posts shall be spaced not more than 100 feet apart and shall be set in the ground to a depth of 36 inches. Post shall be set in concrete bases not less than 10 inches in diameter.

(b) Bracing shall be provided at all ends, gate, and corner posts, the latter in both directions. Horizontal brace rails shall be set midway between top rail and ground running from the corner, end or gate post to first line post. Diagonal tension members shall connect tautly between posts below horizontal braces.

(c) Any galvanized coating damaged during construction of the fencing shall be repaired by application of molten Galvo-Weld, Galvonox, or equal.

(d) For additional requirements see the standard detail drawings H-19 (Fence) and H-20 (Gate).